FORENSIC ENGINEERING STUDY OF DAMAGES TO RESIDENCE OF JOHN & HELEN POLITZ AT 116 WINTERS LANE, LONG BEACH, MS.

FROM HURRICANE KATRINA

PREPARED FOR

HELEN POLITZ

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PREPARED BY

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APPENDICES

Ted Biddy

1. HISTORY

In the early morning hours of August 29, 2005, Hurricane Katrina made landfall on the Mississippi & Louisiana coastlines. The actual eyewall came ashore on August 29th at 1100 GMT (Greenwich Mean Time) at Grand Isle, Louisiana. Greenwich Mean Time (GMT) is the zero meridian time by which the whole world calculates time. GMT is 6 hours ahead of Central Standard Time (CST) and 5 hours ahead of Central Daylight Savings Time (CDST). Therefore, the hurricane landfall at Grand Isle, Louisiana was at 6 A.M. Central Daylight Savings Time. This landfall had maximum sustained winds between 135 – 145 miles per hour (MPH) with higher gusts. A second landfall at a point near the Mississippi – Louisiana border occurred not many hours later. The storm was so large in diameter that the full effects of the strongest winds in the northeast quadrant of the storm were being felt along the Mississippi coastline when the eyewall came ashore at Grand Isle.

Elevated water levels also occurred all along the Gulf Coast, but the National Oceanic and Atmospheric Administration (NOAA) recording stations all had sensor transmission failure. Therefore, NOAA only reported the high water level at a recording station up to the time the station failed. One must look to other evidence to determine the highest water level (storm surge) at locations along the coast.

Because of poor planning and construction or by not anticipating a hurricane of Katrina's intensity, virtually all of the official measuring stations which record high water levels and wind speeds failed during this storm. NOAA explains the water level records and station failures in their Preliminary Report for Hurricane Katrina Storm Tide Summary which is included in Appendix D hereto. However, before the water level recording stations failed, the station at Ocean Springs, Mississippi had recorded the highest water level of any

station at 4.043 meters (13.26 feet) above mean low lower water (MLLW) at 13:18 GMT (8:18 AM, CDST). We know, of course, that Hurricane Katrina's highest water level reached much higher levels based on other evidence.

The National Weather Service (NWS) Post-Tropical Cyclone Report on Hurricane Katrina for the period August 28-29, 2005 is also included herein in Appendix D. In this report the NWS shows all the wind data before power interruption occurred "prior to peak wind and minimum pressure occurrence." The highest wind velocity reported by the NWS for the Mississippi Coast area was 108 knots (124.4 MPH) at the Pascagoula – Jackson County Emergency Operations Center. The NOAA "Summary of Hurricane Katrina", also included in Appendix D, also states that the wind speeds were approximately 110 knots (125 MPH) at the second landfall on the Mississippi/Louisiana border.

I have also studied a recent report by DMD Services of Destin, Florida for the details of the wind and water at the John and Helen Politz residence at 116 Winters Lane in Long Beach, Mississippi. Mr. John Politz recently passed away. In this report, meteorologist Rocco Calaci analyzes the weather elements that took place at the Politz house from 4 PM on August 28, 2005 to 4 PM on August 29, 2005 during Hurricane Katrina. The report determined the wind speed and direction at the property by establishing a baseline of wind speed as correlated to the rate of change to the regional pressure gradient field (PGF). Mr. Calaci used real-time data from Mobile, Alabama; Pascagoula, Mississippi; Gulfport, Mississippl; and New Orleans, Louisiana for several hours to determine the baseline. He then used a basic meteorological principle that, as a change in the pressure gradient between two points increases, you can expect a proportional increase in the wind speed between these points. The reason Mr. Calaci had to resort to these PGF calculations was due of course to the very scarce wind measurements in the area during

the storm, most all NWS equipment having been blown down before the highest winds occurred.

Using his methodology, Mr. Calaci determined that the sustained winds in Long Beach were in the range of 130 MPH with gusts up to 150 MPH in the morning of August 29th before the maximum storm surge high water elevation occurred. He also found that hurricane force winds occurred at the property for over eight hours. He stated that the winds were from the east-northeast until the late morning of August 29, 2005, then later gradually shifted to the southeast, with this wind direction acting as a deterrent from any "crashing wall of water" moving onshore. The Calaci report is included herein as Appendix I.

The DMD/Calaci investigation at the Politz property also found strong evidence of one (or more) microburst in the area with winds of 150 MPH, stating in his report that, "it is very conclusive that a microburst hit this region." He cites evidence from photographs that show, "the houses that made up the cluster of homes in this area are totally destroyed in a circular pattern with trees still standing surrounding this circle of destruction." Mr. Calaci also found evidence of these and other types of severe weather in the area from NWS NEXRAD images which he studied, including microbursts, echoes with appendages, bow echoes, and severe thunderstorms. Mr. Calaci also points out that just as the eyewall of the hurricane came ashore in western Mississippi, the strongest section of the eyewall was just south of the region and headed due north. He further states that this portion of the eyewall carried the most intense winds and strongest radar echoes with several tornadic cells.

These severe weather events occurred while the winds were from an east-northeast direction before they shifted to the southeast, and long before the storm's high water surge reached the property.

The DMD report authored by Mr. Calaci fits very well and is confirmed by the U. S. Navy's "Naval Meteorology and Oceanographic Command" (NMOC) published document from their location at the Stennis Space Center in Hancock County, Mississippi. This document, entitled "Preliminary Model Hindcast of Hurricane Katrina Storm Surge", presents the results of a computer model of the winds and storm surge of the hurricane for all cities along the Mississippi coastline. Specifically for the area near Gulfport City Hall, not far from the Politz property, the NMOC graph of wind speed versus water level shows the highest winds occurring at 9 AM with the water level at about elevation 18 feet, and the highest water level occurring 2 hours later at 11 AM on August 29th. The graph shows the water level at approximately 7 feet at 7 AM; at 13 feet at 8 AM; at 18 feet at 9 AM; at 22 feet at 10 AM; and at 27 feet at 11 AM. These elevations are at the shoreline and did not consider the onshore topography which would have lowered and delayed these high water levels at the condominium property. Many measurements of the high water level at buildings in Gulfport, and other meteorology reports which did include the inshore topography show the maximum water level only reaching about 24 feet. This three feet differential would result in the correct water levels at the Politz property being 10 feet at 8 AM; 15 feet at 9 AM; 19 feet at 10 AM; and a high of 24 feet at 11 AM. Therefore, the water level never reached the Politz house floor level of 14.8 feet until about 9 AM, which gave the high winds up to 150 MPH about 3 hours to destroy the building before any damaging waters reached the level of the house. As demonstrated herein, the highest winds destroyed the building before the water reached the Politz floor elevation level. The NMOC data is included herein as Appendix E.

The hurricane winds at the Politz property from 130 to 150 MPH, as shown in the Calaci report, and the high probability of microburst winds of 150 MPH or more, occurred while the storm's water level was much too low to affect the building. The elevation of the floor level of the building was at 14.8 feet. Obviously, no storm water reached the ground floor level until about 9 AM based on the NMOC data. This level of water at 9 AM could not have caused structural damage to the building. Only an hour to two hours later would the waters have started to affect the building area. Therefore, at the very peak high water at 11 AM, there was about 9.2 feet of water above the floor level of the house; but, the wind damage had been accomplished by that time, and there was only the concrete slab on grade remaining for the waters to attack.

For my evaluations and structural calculations as contained herein, I have selected a conservative value of the wind speed gusts at 135 MPH, which is 10 to 15 MPH below the wind gusts as shown in the Calaci report, and is much below the microburst winds which probably occurred at the property.

The high water level or storm surge of a hurricane and specifically Hurricane Katrina is generally misunderstood by the general public. Most people think that the storm surge is a virtual wall of sea water that suddenly comes ashore as the hurricane makes landfall, as in a tidal wave caused by an earthquake at sea. While this may be true to a very small extent at the actual center of the eyewall of a hurricane as it makes landfall, it is not true for the storm surge or high water away from the center of the storm. Rather, the rising of the storm surge or high water is a gradual occurrence as you get further from the center of the storm with small wave action, even in the most intense winds of the northeast quadrant of the hurricane. I have interviewed several eyewitnesses to the

Hurricane Katrina high water occurrence, and they each tell very similar accounts. The witnesses state that the water rose gradually, first in the edge of their yards, then by progression up to the steps of their house and finally up on the sides of the house to the highest water level. The witnesses state that the high water stayed at the highest level for a short period of about thirty to forty-five minutes and then receded in the same gradual manner as the water rose. The witnesses who gave these accounts were located in Pascagoula near the water; at D'Iberville on the Back Bay of Biloxi; in Biloxi; at Bay St. Louis; and at Ocean Springs.

The witness who gave the specific account of staying in his home for the entire storm in Pascagoula told me that it was like being in the middle of an aquarium when the water reached its highest level up on the house's windows. Fortunately this witness, Mr. Michael Beall of Pascagoula, was able to ride out the storm with his family by stuffing towels, rags, sheets and whatever was handy into the seepage leaks around his doors and windows and down his commode to stop the geyser from the commode. Mr. Beall was fortunate that he had no breaches or openings in his very strong masonry house from falling trees or flying debris, and he and his family were able to ride out the storm with only ruined carpet damage due to the seepage.

I have also viewed and have a copy of a video taken during the storm from the parking garage of the Beau Rivage Casino in Biloxi. This video shows the high water coming into Biloxi gradually with some swells but no wall of water and no observable large waves or much white capping. The high water proceeds steadily up to Highway 90 and then on under the I-110 bridge and into blocks north of Highway 90 in a gradual manner. The person who filmed this video kept coming back to a brown pelican sitting placidly in the

water adjacent to the parking garage throughout the entire high water "surge" into Biloxi. The pelican seems undisturbed throughout this entire episode.

The most important factor to know when analyzing the destruction and damages of a building such as the Politz house is the sequence of when the strongest winds of the hurricane occurred, and whether the winds occurred in advance of the high water storm surge and caused the majority of the damages or destruction before the high waters reached the site. We have very much evidence that the extremely high winds of Hurricane Katrina did in fact occur several hours before the storm's high water surge arrived at the Politz property. This sequence of the storm's wind and water is thoroughly discussed and analyzed in Part 2 below, Sequence. Proof of the sequence of the storm's winds and waters is also documented in the government agency reports in Appendix D and Appendix E and in the DMD Services report in Appendix I.

2. <u>SEQUENCE</u>

In the study of the effects of any storm upon a damaged or destroyed structure, one would like to have a complete sequence of the water level and wind speed for each hour up to and including the times the damages occurred. In this case, such complete records are impossible to obtain due to the failure of the measuring gages operated by various governmental agencies.

In the absence of such ideal information, we must rely upon what evidence we have coupled with engineering knowledge of hurricanes and common sense. Such is usually the case in most forensic engineering studies of storm damage.

In this case, all we know for certain of the winds of Hurricane Katrina, from the NWS records, is that the winds reached 125 MPH at the Pascagoula – Jackson County Emergency Operations Center and 135 MPH at the Poplarville – Pearl River County Emergency Operations Center before wind equipment was blown down "prior to peak winds."

In this report focusing upon the causes of damages to the John and Helen Politz house, I have selected a wind speed of 135 MPH to use in my structural analyses which is lower than maximum wind gusts given by DMD in their report in Appendix I for the area on the morning of August 29, 2005 and considerably below the winds of the highly probable microburst reported by DMD in the area. This wind speed certainly occurred considerably before the hurricane eyewall entered the area when the highest storm surge occurred at about 11 AM. Remembering that the NMOC water levels given in their report are at the shoreline and would be approximately three feet lower at inshore

areas, the NMOC report's storm water level elevations at the Politz house in Appendix E would be 4 feet at 7 AM; 10 feet at 8 AM; and 15 feet at 9 AM. The water height at 9 AM was at 15 feet according to the NMOC report, which is only 0.2 feet above the Politz house floor level and could do no structural harm. Therefore, my analyses using the 135 MPH wind loading upon the building are conservative with no possibility of any structural damage from the storm's waters.

We know from the NWS records that the 125 MPH winds occurred "prior to peak winds" and from our knowledge of hurricanes, we know that the peak high water occurred sometime later than the 125 MPH winds, probably as the eyewall entered the Mississippi coastline. We also know from the storm reports by NOAA and NWS that the eye of this storm was very large. We further know from the DMD/Calaci report that the 130 MPH sustained winds with gusts up to 150 MPH occurred between 7 AM and 9 AM, with the storm's waters between 7 AM and 9 AM at levels which could not cause structural damages to the Politz house.

The DMD report provides a good scientific explanation of why the storm's high water level stayed low during the early fierce winds of the hurricane. The winds for the early part of the storm were blowing from the northeast and east and did not shift to the southeast until much later in the storm and therefore kept the waters low. The early winds of the hurricane from about 6 AM until after 9 AM did their damage to the Politz property without any possibility of structural damage being caused by the storm's waters.

Considering all of the above reasoning, it should be obvious to any unbiased observer that the forces I used in analyzing the Politz house were conservative on the low side,

and the results of the structural engineering calculations performed were obviously low on the conservative side. It is highly probable that higher winds were likely experienced.

The above reasoning is based on the very few actual records we have for the wind speeds of Hurricane Katrina from the National Weather Service (NWS), and the DMD report. However, I have done further research of documents published by the U. S. Navy's "Naval Meteorology and Oceanographic Command" (NMOC) located at the Stennis Space Center in Hancock County, Ms.

One of the documents of NMOC, published generally for hurricanes, discusses winds of hurricanes as follows:

> "Winds in a hurricane are not uniform, varying from quadrant to quadrant. For example, a hurricane with 100 mph winds, moving north at 15 mph, will have 115 mph winds in the right front sector, but only 85 mph winds in the left front. This is due to the forward speed either adding to, or taking from the total wind force."

This document simply confirms what we have known from the records of many storms that the highest winds are indeed in the right hand quadrant which would be the northeast quadrant for a storm moving north. As applicable to Hurricane Katrina and the Long Beach area, the NMOC document confirms that the wind speeds at this northeast quadrant of the storm should have been 10 to 15 MPH higher than at the storm's center, that were reported by the NOAA at 125 MPH at landfall near the Mississippi – Louisiana border. Therefore, as I have postulated above, the actual hurricane winds in the Harrison County area on the coast would have been about 135 to 140 MPH, despite the

lower 125 MPH winds reported by the NWS before wind equipment was blown down or power went out "prior to peak winds."

Another document that was published by the NMOC, dated 21 November, 2005, is entitled "Preliminary Model Hindcast of Hurricane Katrina Storm Surge". In this computer model of Hurricane Katrina's storm surge and winds, NMOC presents graphs of the elevations of the high water level of the storm plotted for Latitude and Longitude along the coastline for times up to Noon on August 29, 2005. The document then presents the model results with graphs which show plots of wind speed versus water level over times from August 28, 2005 through August 29, 2005 at cities from Waveland, Mississippi to Ocean Springs, Mississippi.

This second set of graphs is very instructive concerning the sequence of winds and high water of the hurricane. For all cities shown in Mississippi, the graphs show the highest winds of the storm preceding the highest storm surge by several hours in this northeast quadrant of the storm. Specifically for the Long Beach area, the graph of wind speed versus water level shows the highest wind speeds occurring at 9:00 AM on August 29th with the later arriving storm surge high water occurring about two hours later at about 11:00 AM on August 29th. This is good confirmation to my conclusion concerning the sequence of wind and water that I have stated from the beginning of my studies of the hurricane damage on the Mississippi Coast and completely confirms the sequence of wind and water levels as reported in the DMD report. Perhaps the insurance companies will recognize the truth of the sequence of the storm's wind and water when they see the NMOC document and the DMD report of the property.

With the highest winds of the hurricane lashing the coastline at Long Beach for about two hours before the storm's high water arrived and high winds occurring at 9 AM according to the NMOC report, it is little wonder that everything that could be destroyed by these winds, including structures that completely blew away from lack of anchorage, were in fact greatly damaged or destroyed. Furthermore, the NMOC graph of wind speed versus water level over time shows that the water level at the 9 AM time of the highest winds was only at elevation 15 feet, which is only 0.2 feet above the floor level of the Politz house and could do no structural damage. Obviously, the waters of the storm had nothing to do with the wind damage to this house.

Both the NMOC general article on hurricane characteristics and the computer model of the winds and storm surge of Hurricane Katrina are included herein as Appendix E. The DMD report is included as Appendix I.

I have also received an affidavit from Mr. George Sholl who works as the director for the Jackson County Emergency Communications District. In this affidavit which is included herein as Appendix F, Mr. Sholl tells of being in the Emergency Operations Center (EOC) in Pascagoula during the hurricane and his observation of the wind speeds there from anemometers mounted on the EOC building. Mr. Sholl states that the two anemometers were professional type equipment and accurate to the best of his knowledge. He states that he observed the indicated wind speed from this equipment starting Sunday night, August 28, 2005 at 75 MPH up to the early daylight hours of Monday, August 29, 2005 at an indicated wind speed of 137 MPH. He states that shortly thereafter sections of the EOC building roof blew off, and he evacuated to the nearby courthouse. He further reports that some personnel in the EOC building stayed for a short time after he left and observed the indicated wind speed at 140 MPH. He

further states that the anemometers' tower blew down approximately 20 minutes after he left, and no more wind speed readings were possible. Mr. Sholl then states that the winds continued to increase after the tower blew down, and he estimates that the winds must have been over 150 MPH. He further states that the highest flood waters came later.

This is a most amazing affidavit and is made even more credible when we realize that the National Weather Service (NWS) reported a peak gust at this same EOC building of 125 MPH "before wind readings ceased due to power failure." As the director of the Jackson County Emergency Communications District, Mr. Sholl's affidavit is very believable and completely fits with the published data from the Naval Meteorology and Oceanographic Command's article that the winds in the northeast quadrant of a hurricane are 10 to 15 MPH higher than at the center of the storm.

Therefore, the evidence is overwhelming and conclusive that the wind speeds in the northeast quadrant of Hurricane Katrina along the Mississippi Gulf Coast were 135 MPH to 140 MPH and above, perhaps up to 150 MPH, and that these winds occurred before the storm's high water reached a damaging height at the Politz property. From the utter devastation I am observing for structures along the Gulf Coast, these higher than NWS reported wind speeds do not surprise me in the slightest.

3. INSPECTIONS, EVALUATIONS AND PHOTOGRAPHS

A. INSPECTIONS

I began my inspections, evaluations and taking of photographs at the John and Helen Politz house at 116 Winters Lane in Long Beach, Mississippi on June 7, 2008. I was assisted by my inspector Rodney Shreve during the inspection at the property.

Upon arriving at the property, I observed that the house and attached garage were completely gone with only the concrete slab foundations remaining. The site had been cleaned up of all house debris except for the remaining slab and some base plates, anchor bolts, and metal straps from the slab to the base plates. The slab was left clean of other house debris remnants, but the after storm photographs furnished by the owner showed the slab with remnants of the destroyed house and debris scattered to the northwest. The debris from the destroyed house was primarily the brick veneer and chimney brick which had fallen down around the slab, with most all of the lighter wood portions of the house blown to distant areas. The base plates showed many nailed connections to the former studs above, nailed connections to some light gage metal straps, some broken straps with no sign of any heavy duty or adequate hurricane anchors from studs to base plates. The driveway connecting the house and garage slab to Winters Lane also remained. Therefore, my inspections were limited to observations at the house and garage slab foundations, anchor bolts, straps, destroyed trees on and off the property, and surrounding areas as well as study of after storm photographs.

The owner furnished many after storm photographs of the remaining slab and debris taken soon after the storm, which I have included herein as Appendix B. All of these data together with my inspection were sufficient for me to determine the cause of

destruction of the house and garage. I noted that the structure had been oriented with its front entrance side to the northeast to Winters Lane. The Mississippi Sound is located a few hundred feet south of the property.

I carefully examined the remaining slab foundations, anchor bolts, straps, and the base plates remaining and all of these details in the after storm photographs of the Politz house. I found a glaring lack of hurricane anchors and attachments from the wood studs at the bottoms of walls to the base plates with alternate studs being toe-nailed only to the bottom base plates and the other alternate studs being attached to the base plates with light gage metal straps nailed to the studs. All studs had been attached by some form of nailing to the base plates or metal straps which ran under the base plates. There was no evidence of hurricane anchors, ties or heavy duty straps from studs to base plates and slab. There were anchor bolts from base plates to concrete slab spaced at 3 to 4 feet. The walls of the structure had been attached to the base plates by simple nailing to base plates or metal straps. The after storm photographs in Appendix B also show broken studs still attached to the base plates on the north leeward side of the house where stud failures had obviously been due to bending stress in the stud. Some house studs failed due to bending stress, and the nailed attachments at the bottoms of other studs were inadequate to resist the early winds of a storm of Katrina's ferocity.

This house and attached two car garage had been a beautiful one story, wood framed, brick veneer, gabled structure with slab on grade type foundations. The house had contained approximately 1,523 square feet of heated and cooled area with the attached garage containing 462 square feet. The house had been a two bedroom, two bathroom home with covered front porch, and a covered and wrought

iron fenced 397 square feet patio. The house had one fireplace and chimney. The elevation of the floor level of the house had been at 14.8 feet according to the survey in Appendix D. The house was reportedly built in 1995. The before storm photographs in Appendix B show the appearance and some of the details of the house before the storm.

I took photographs of the former location of the house and attached garage; the remaining slab foundations; the remaining base plates; anchor bolts; concrete nails; and metal straps; and general views of the property and surrounding areas. The photographs I took at the site, upon which I added annotations to explain each photograph, are included as Appendix A hereto. The photographs furnished by the owner are included as Appendix B. The photographs I obtained at the area and those furnished by the owner all show extensive broken and damaged large trees in the area which attest to the wind's high velocity and probable microburst in the area.

Based on the inadequate strength of wall studs and the inadequate anchorage of the structure's walls to the bottom base plates to concrete slab to resist Hurricane Katrina's intense winds, I knew from my engineering experience that this house and attached garage had simply blown away from the early winds of Hurricane Katrina. It only remained to be proved and demonstrated as to the sequence and mechanism of the destruction of the house. It is assumed that the house construction met the building code when the house was constructed, because it was obviously permitted and inspected when it was built. However, no preexisting code before Hurricane Katrina would have provided adequate attachments for the intense winds of this storm, and the house was doomed to total destruction in winds of 135 MPH or more.

B. EVALUATIONS

My evaluations of the hurricane forces on the Politz house were based on my visual observations of the remaining slab, base plates, anchor bolts, straps, nails, and the after storm photographs showing base plates and slab foundations with attachments from the base plates to the former wall studs above, and also showing broken studs still attached to base plates. I studied many photographs furnished by the owner of after storm remaining base plates, foundations, debris and grounds. I also performed detailed structural engineering calculations included in Appendix C for the intense storm forces on the building's structure.

My structural engineering calculations of the forces of the 135 MPH wind upon the structure as a closed and an opened structure showed that the bending stresses in the walls were more than the allowable stresses and enough to cause wall failures. The windward side walls would have failed in bending under direct wind loading, and the leeward side walls of the structure would have experienced massive blowout failures after the windward sides were opened up. The photographs of the broken studs still attached to the north side leeward side confirm the stud failures from wind loading. Of course we know that the winds of the hurricane may have been much higher than the 135 MPH winds I used in my analyses.

The calculations assume that there is adequate anchorage at the bottoms and tops of the wall studs to resist the wind forces and even so, the wall studs were found in an overstressed condition. But since we know, based upon my inspection, that there was very weak anchorage at the bottoms and most probably at the tops of the walls to base plates and base plates to slab, we must look to what effect the wind forces would have had on these weak anchorage points. The probable connections of the

trusses or rafters and studs to the top plates by nailing only would only have had the pull out resistance of the nailed connections to resist the large wind forces, which is simply inadequate to prevent the nailed joints from pulling free. For instance, a nailed connection with 3 ten penny nails provides about 150 pounds of pull out resistance compared to more than 300 pounds of force at the bottom and top of each stud from the storm's 135 MPH winds. Obviously, these connections will fail if other elements of the structure do not fail first.

Since we know, based upon my inspection, that the wall studs failed by pullout from their nailed connections to bottom base plates, and nail pullouts from metal straps, and metal strap failures through breakage, it is certain that the nailed on wall studs failed at their bottom connections. It is therefore an engineering certainty that the wall studs to bottom base plates could not withstand the forces from the 135 MPH winds of the storm.

The most probable sequence of failure of the structure occurred as follows. With very little anchorage from the roof trusses or rafters to the tops of the walls, the forces of the wind would have caused the roof structure to pull free from the nailed connections and to rise up and fly away as an airfoil due to both the positive forces on the windward sides of the structure and the negative outward and upward wind forces on the lee sides of the structure. The remaining walls were then cantilevered beams subject to the horizontal wind forces and followed in failure soon thereafter. This mechanism of destruction is well known and happens in virtually every severe storm.

If the roof structure of this house and attached garage did not blow away first, then it is certain that the entire structure blew away in the early winds of the storm due to the

inadequate anchorage of the bottoms of walls to the base plates. My calculations of the forces of the winds at the bottoms of the walls compared to the small anchorage forces furnished by the direct nailed connections of studs to base plates and metal straps to studs show certain failures at these connections.

It is true that the high water level of the storm at the Politz house would have placed about 9.2 feet of water above the floor level and would have greatly damaged or destroyed a closed structure, but the high water level came much later than the initial 135 MPH winds. When the high water came, the house and attached garage had already blown away and were destroyed. Obviously, anything remaining of value was then destroyed by the several hours later arriving high water.

The engineering analyses and structural calculations I performed for the Politz property, house and attached garage prove with engineering certainty that the winds of Hurricane Katrina were the cause of the first destruction of the building and contents, with the later storm water causing no structural destruction.

C. PHOTOGRAPHS

As a part of all of my onsite investigations of a damaged or destroyed structure, I take a series of photographs to show the damages to the building. I took a series of photographs which are included herein as Appendix A to show the structural destruction as I have discussed above in my evaluation. I have annotated each photograph, and they are self explanatory. The after storm photographs furnished by the owner are included as Appendix B.

4. <u>WIND OR WATER DAMAGE</u>

It is well known that homeowners' insurance policies exclude damages due to flood waters from a storm but cover damages due to winds from such storms. Therefore, an insurance company, in arriving at a fair and equitable appraisal of damages from a hurricane such as Katrina, must determine what damages were caused by winds from the storm and what damages were caused by flood waters. Of course we know that flood insurance may be purchased over and above the homeowner's policy, covering flood damages alone. Also, wind damage policies may be purchased separately.

Mathematical set theory may provide a means of understanding the insurance claims resulting from Hurricane Katrina to the Politz house at 116 Winters Lane in Long Beach, Mississippi. Set "A" can be considered those damages resulting from insured perils covered by windstorm in the total absence of insured perils covered by flood insurance. Examples of this would be the blown away building from the storm's winds before the high water level occurred. Set "B" can be considered as those damages resulting from insured perils covered by flood insurance in the total absence of insured perils covered by the windstorm insurance. An example of this set "B" at this property would be the later waters which damaged anything remaining of the building and yard and grounds.

There are two other possible sets, namely set "AB" and set "BA". Set "AB" would be those insured perils which require set "A" to be present in order for set "B" to cause damages to take place. An example of set "AB", as fully explained in Section 3 above, would be the blown away building by the storm's winds which allowed the later storm waters to enter the house area and destroy anything remaining. An example of set

"BA", which requires set "B" to be present in order for set "A" to cause damages to occur does not exist at this house.

It would be tempting to try and draw a dividing line at the so-called high water line and attribute all damages from this line and below to flood waters and all damages above the line to windstorm. However, this simplistic explanation will not answer the question of which "set" caused the other damage or caused the mechanisms of structural failures to occur. Only a thorough forensic engineering evaluation of the structural forces upon the building and the sequence of such forces can explain the failures of the structural elements of the building, which allowed the winds or the waters of the storm to do their damage.

There is no absolutely precise way to divide the damages caused by wind or water. The analyses I performed in Section 3 above clearly showed that the first cause of the destruction of the house and attached garage was due to the windstorm early on in the storm. The later storm waters then did no further structural damage.

5. WIND LOADING FROM STORMS

All building codes mandate a minimum wind speed that all structures must be designed and constructed to. However, even if the structure is well designed and constructed to the required wind speed, this does not exclude other forms of damage to a structure in a wind storm such as windows broken, projectiles or flying debris impacts which open up a structure, loss of non-structural elements, etc. Also, major structural damage can occur to a structure when trees or other objects fall or impact on a structure. A designer cannot anticipate these unusual loading conditions. Moreover, building codes in Long Beach, Mississippi at the time the Politz home was built did not require construction designs to resist 135 MPH winds, or greater, such as those inflicted on the Politz home by Hurricane Katrina.

In the Mississippi Coast area, the damage seen to structures from wind loading from Hurricane Katrina predominately fall into three damage or mechanisms of destruction categories as follows:

1. Inadequate attachments from roof structure to wall studs and wall studs to base plates and improper anchorage of base plates to concrete foundation or piling to resist the 135+ MPH winds inflicted by Katrina.

   When such inadequate attachments exist, the mechanisms of destruction which I have seen from the winds of Hurricane Katrina on the Mississippi Coast have been roofs destroyed by pulling free of their nailed attachments and blowing away like an airfoil; walls pulling free from their nailed connections to bottom plates and flying away in destroyed small pieces; and

entire structures pulling free from anchorage to foundations and being moved off their foundations.

Wall studs that are straight nailed or toe nailed to bottom or top plates provide little resistance to hurricane wind forces of Katrina's velocity and are relatively easily pulled free from nail connections, and the wall section is no longer attached to the structure and is a certain failure. For instance, a stud connection with 2 ten penny straight nails provides a pull out resistance of perhaps 100 pounds compared to the Hurricane Katrina wind loading of 300 pounds or more at these connections. Toe nailing with 4 eight penny nails provide only about 184 pounds of pull out resistance compared to the applied load of at least 300 pounds by the 135 MPH+ winds of Hurricane Katrina.

Similarly, roof structure rafters or trusses which were connected with nailed connections could not provide the pull out resistance to resist the wind loading at these points by Hurricane Katrina, and the pulled free roof structures simply "sailed" away in the storm's winds like an airfoil. This is a common structure failure which is well known and happens in virtually every severe storm to structures with such "nailed on" roof structures.

Sometimes the weakest anchorage point is the wall connection to the foundations which I have seen in a number of wind destruction cases I have investigated after Hurricane Katrina. In this case the entire structure will slide off its foundations and be translated in the direction of the wind.

The hurricane wind loading will always attack the weakest connection point along the roof to walls to foundations load path to initiate a structural failure at this weakest point. When such a failure occurs, the remaining structural elements of the structure are greatly compromised and usually are quick to follow in failure. For example, when a roof structure is blown away, the walls become freestanding cantilevered structures which are then easily destroyed in the horizontal wind loading of a hurricane such as Katrina. I have seen this exact mechanism of destruction in Hurricane Katrina destruction cases I have investigated.

2. Another common category of damage or mechanism of destruction which I have seen frequently while investigating Hurricane Katrina damage cases on the Mississippi Coast consists of breached windward side walls from flying wind borne debris, fallen trees and other objects which penetrate the "closed structure", changing the structure to an open structure. In such cases, the wind loading on the lee side walls of a structure are immediately greatly increased and most often results in blowouts of the walls on the lee side of the structure. This blowout is usually immediate and catastrophic as the bending in an outward direction of the lee side walls is much greater than wall stud bending resistance. In the 135 MPH+ winds of Hurricane Katrina, the bending stresses were calculated at more than 4,000 pounds per square inch (psi) compared to an allowable bending stress in the wood studs of about 1,500 to 1,600 psi. With such a bending overstress, the result literally looks like an explosion of these walls outward from the structure. When these wall blowouts occur, everything within the structure is blown through the resulting openings to far and distant places. In most such cases I have investigated on

the Mississippi Coast, all interior wall coverings and furnishings were blown through the blown out lee side walls with little to none of the inside furnishings ever found.

When flying debris, falling trees or other wind blown projectiles puncture the structure's envelope, wind can enter the structure from the windward side and "pressurize" interior spaces. The structure blows up like a balloon which creates upward lift forces on the ceiling and roof and creates horizontal outward side loads on all interior walls. These outward horizontal side loads within the opened structure combine with the negative outward pressure forces on the outside of the lee side exterior walls caused by the hurricane's winds. The result of this combination of wind loading is that the lee side walls are greatly overstressed in outward bending, and these walls immediately fail in a bending failure mode. This failure, after the closed structure is breached or opened, is immediate and catastrophic which literally looks like an "explosion" of these lee side walls. The failed lee side walls of such a structure are due to dynamic pressure inside the structure in combination with the negative forces of the winds on the lee side walls. The pressure effect inside a structure cannot be relieved by opening a window, but such action would only increase the interior pressurization.

3. A third category of damage or mechanism of destruction I have seen from the winds of the storm while investigating Hurricane Katrina damage on the Mississippi Coast is simply dynamic loading on the windward side walls of structures where the walls were inadequately designed and/or constructed to withstand the wind loading directly on the windward side caused by Katrina's

severe winds. An example of these type walls which I have seen in front wall failure cases would be prefabricated sections of walls with straight nailing with two nails from top and bottom plates to studs. In such cases, the windward side walls fail inwardly in bending, shear or attachment pullout, and the structure then becomes an open structure with all the subsequent massive destruction as described in 2 above.

In the case of the Politz house at 116 Winters Lane in Long Beach, Mississippi, all of the above mechanisms in all likelihood contributed to the total destruction of the home. As noted above, the structure's bottoms and tops of walls were inadequately attached to base plates, and roof structure and base plates were inadequately attached to the concrete slab. With the wall studs only having nailed connections to bottom base plates and metal straps, and top base plates in all probability only having nailed connections to roof structure, the roof and wall structures simply blew away in the early winds of the storm. In addition, the extent of flying debris from nearby homes and piers in all likelihood created breaches in the home's integrity, allowing destructive winds to directly enter the house. Finally, the pressure of the wind was more than sufficient to cause dynamic overloading which would result in the home's destruction, as shown by the broken studs on the leeward side of the Politz house.

6. COST ESTIMATE OF RECONSTRUCTION

The preparation of a cost estimate to rebuild the Politz house and attached garage is a difficult task and must be considered approximate. The greatest unknown is the cost of construction and materials over the next two years due to the massive amount of rebuilding that will be occurring in the area that will cause an extreme demand upon builders and building materials. No contractor will be willing to give a fixed price but will have to do the work based on time and materials plus a markup for overhead and profit to guard against increases in costs during the Gulf Coast rebuilding time frame.

In my estimates which are included in my reports as Appendix G, I had previously used the published R. S. Means Residential Cost Data. This cost data would have been for deluxe, one story, wood frame, brick veneer construction for the Politz house. The deluxe classification is appropriate based on the before storm photographs and the descriptions of the house. However, my estimates of reconstruction costs for houses I have previously performed using the R. S. Means cost data have proven to be excessively low, based on the current building climate in the after-Katrina home building industry of the Gulf Coast.

I have discussed the current going rate for the reconstruction of quality built and deluxe homes on the Gulf Coast with several local contractors. My latest inquiry was with local house builder Carl B. Hamilton who reports to me that the current going rate for the base cost of such construction ranges from $150.00 to $176.00 per square foot. Mr. Hamilton cites the huge increase in labor as the main reason for the extremely high cost of this construction compared to pre-Katrina costs. For example he says that previous to Katrina, labor for such construction ran about $12.00 to $14.00 per hour,

but was now about $18.00 to $20.00 per hour. He also states that materials have also increased substantially.

I have therefore prepared the cost estimate for the reconstruction of the Politz house and garage, which is attached hereto as Appendix G, using the base cost as $175.00 per square foot for a quality built deluxe house. I then arrived at a base cost of the reconstruction of the 1,523 square feet of living area at $266,525. To this base reconstruction cost, I added costs of additional bathroom, appliances, garage, fireplace and chimney, and covered porch and patio not included in the base cost for a total estimated contractor's construction cost of $350,675. I then added the contractor's usual fifteen percent for overhead and profit of $52,601 and arrived at a total estimated reconstruction cost to the owner of $403,276.

This estimate of $403,276 is my best estimate at the present time to reconstruct all facilities on this property. No consideration has been given in this estimate as to any amount of depreciation of the original structures.

It appears obvious that construction costs will continue to rise substantially in the next few months on the Gulf Coast due to the demand for builders and building materials. I believe that such costs could rise as much as 33 1/3% to 50% over the next two years. Therefore, my present estimate of $403,276 could increase substantially over the next two years.

7. SUMMARY OF CONCLUSIONS

A. Hurricane Katrina was a massive storm covering a broad area. The hurricane's eyewall made landfall in the early morning hours of August 29, 2005 first at Grand Isle, Louisiana at 6:00 AM CDST and a few hours later at the Mississippi – Louisiana border. The most powerful winds in the northeast quadrant of the storm had already been lashing the entire Mississippi coastline and continued to do so over the next several hours.

B. The winds of the hurricane caused wide-spread devastation of homes and other structures from the center of the storm eastward through Bay St. Louis, Long Beach, Gulfport, Biloxi, Ocean Springs and Pascagoula on the Mississippi Coast and on to Mobile, Alabama.

C. The winds of the hurricane caused extensive damage to structures long before the maximum water height storm surge reached the coastline. The NWS Post-Cyclone Report on Hurricane Katrina in Appendix D hereto stated that the wind data shown in the report occurred "prior to peak wind and minimum pressure occurrence."

D. The NWS showed a measured wind speed of 125 MPH at Pascagoula before wind data ceased due to power interruption, and NOAA reported a wind speed of 125 MPH at the second landfall at the Mississippi – Louisiana border.

E. The Calaci meteorology report for the Politz property prove that winds between 130 MPH and 150 MPH occurred at the area, long before the highest water of the storm affected the property. Other meteorology reports in the area confirm the wind speeds and sequence of the high winds occurring hours before the high water arrived.

F. Using wind speeds of 135 MPH for analyzing the damages to the Politz property in Long Beach is conservative on the low side and produces forces on the structure which are conservative on the low side.

G. The high water storm surge at the Politz house and attached garage in Long Beach occurred about 2 hours after the occurrence of the highest winds according to the NMOC model in Appendix E and over 3 hours after the 130 to 150 MPH earlier winds of the storm according to the Calaci reports for the property. The destructive winds had over 3 hours to destroy this house and attached garage before <u>any</u> destructive waters entered the house. The Calaci report also cites the certainty of a microburst at the property with winds up to 150 MPH.

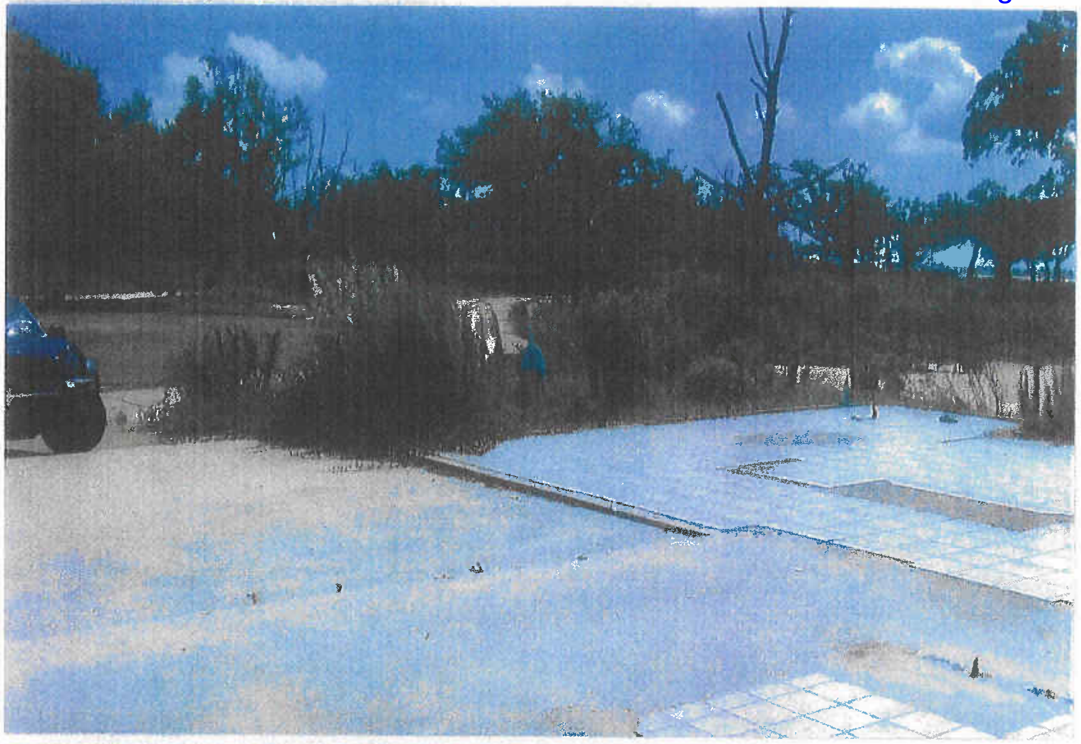
H. My structural engineering calculations for the 135 MPH early winds of the storm on the structure show certain failures through pull-outs of nailed attachments of studs to base plates and nail attachment failures at top of wall connections to roof structure. The walls pulled free of the base plates, and the house was blown away in pieces. My calculations also show bending stress failures in stud walls and blowouts of leeward side walls after direct wind loading or flying debris opened the windward side.

I. The photographs furnished by the owner show the property before and immediately after the storm. The after storm photographs which I obtained show the extent of destruction of the house and attached garage on the property and surrounding properties.

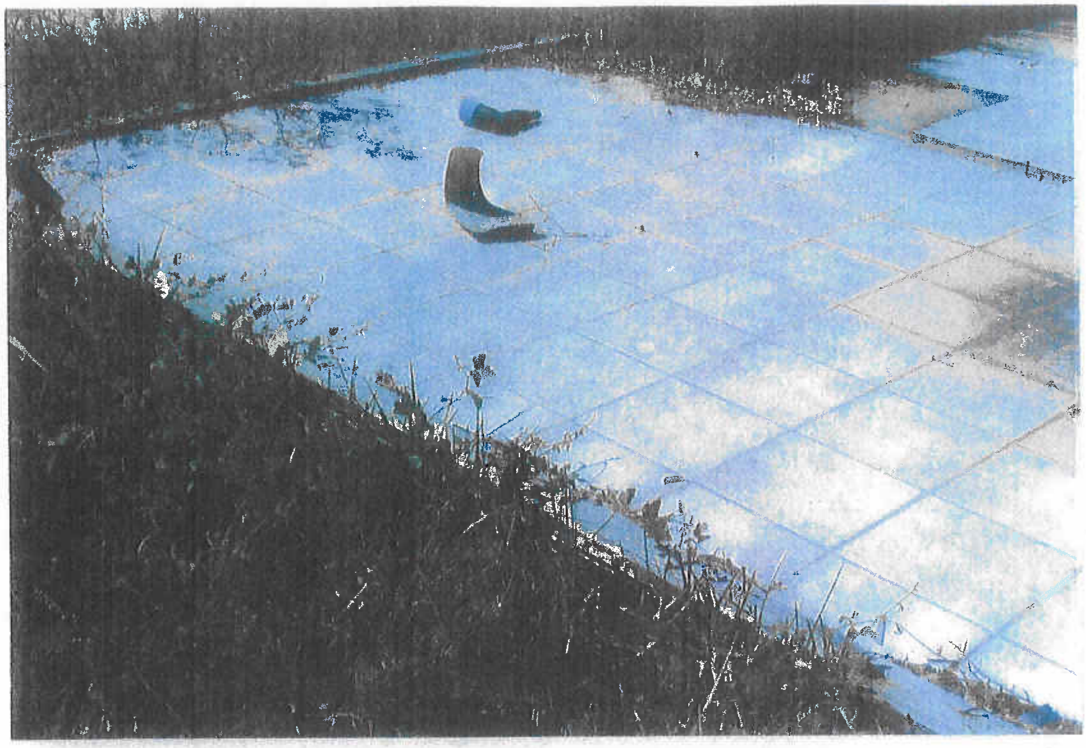
J. Based upon my forensic engineering study, I conclude that the root cause of all of the structural destruction of the Politz house and attached garage was the early winds of Hurricane Katrina.

K. I estimate that the total current replacement cost of this house and attached garage would amount to $403,276.

APPENDIX A



VIEWS OF REMAINING CONCRETE SLAB FOUNDATIONS



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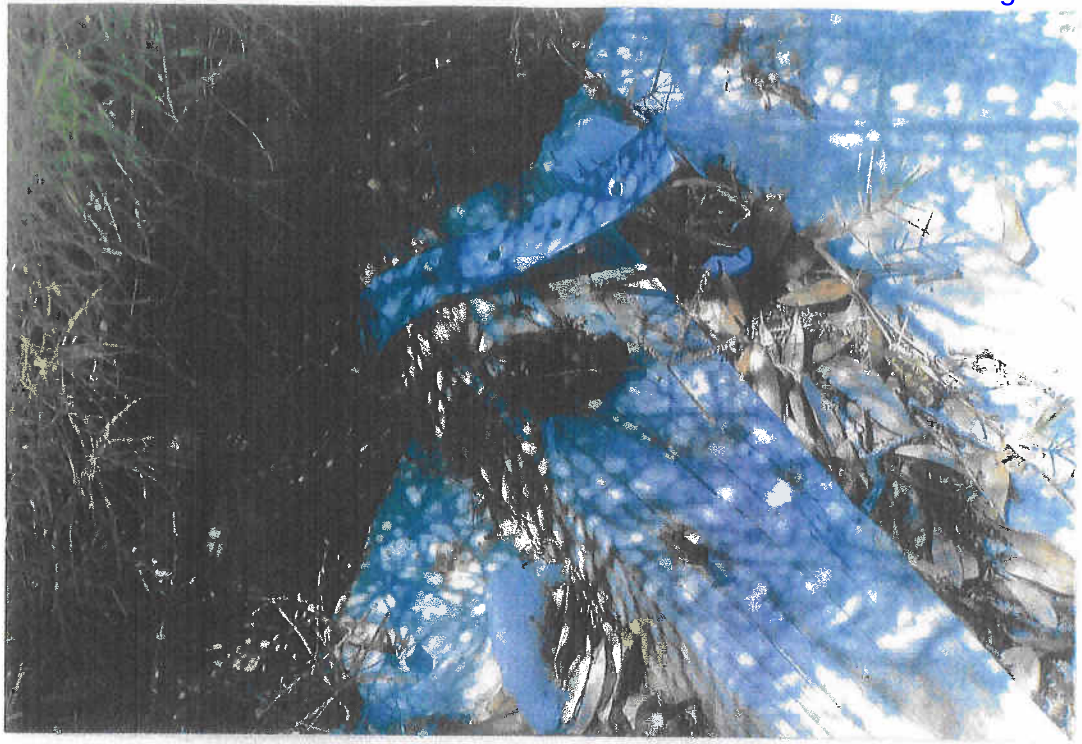
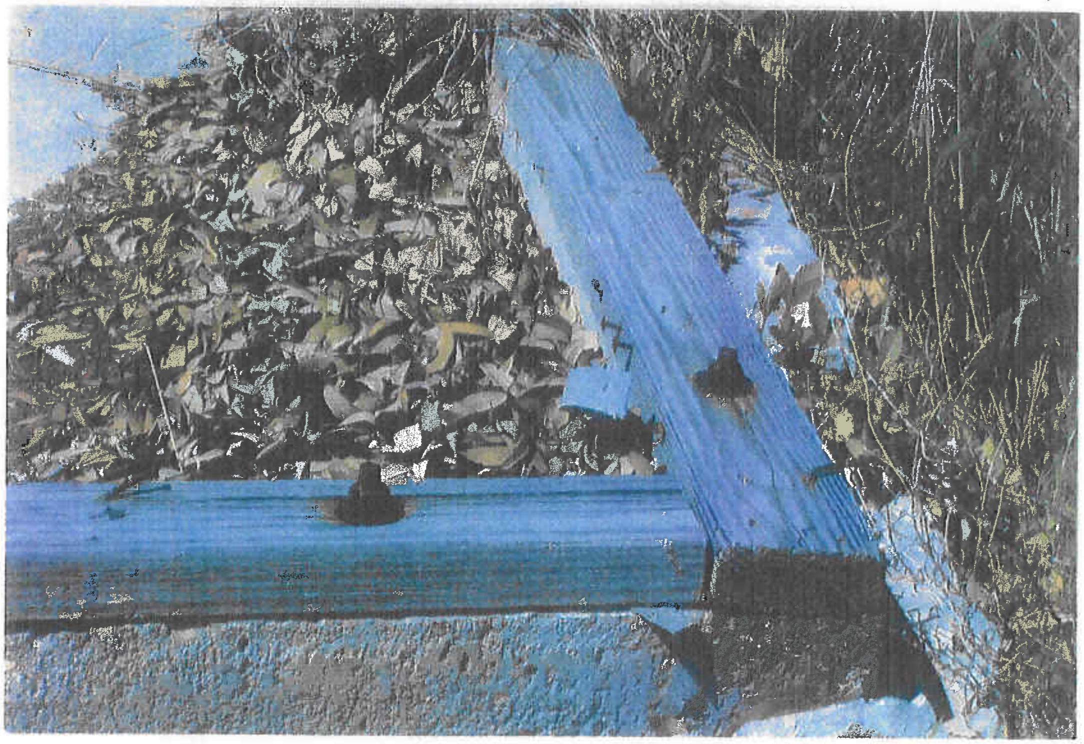
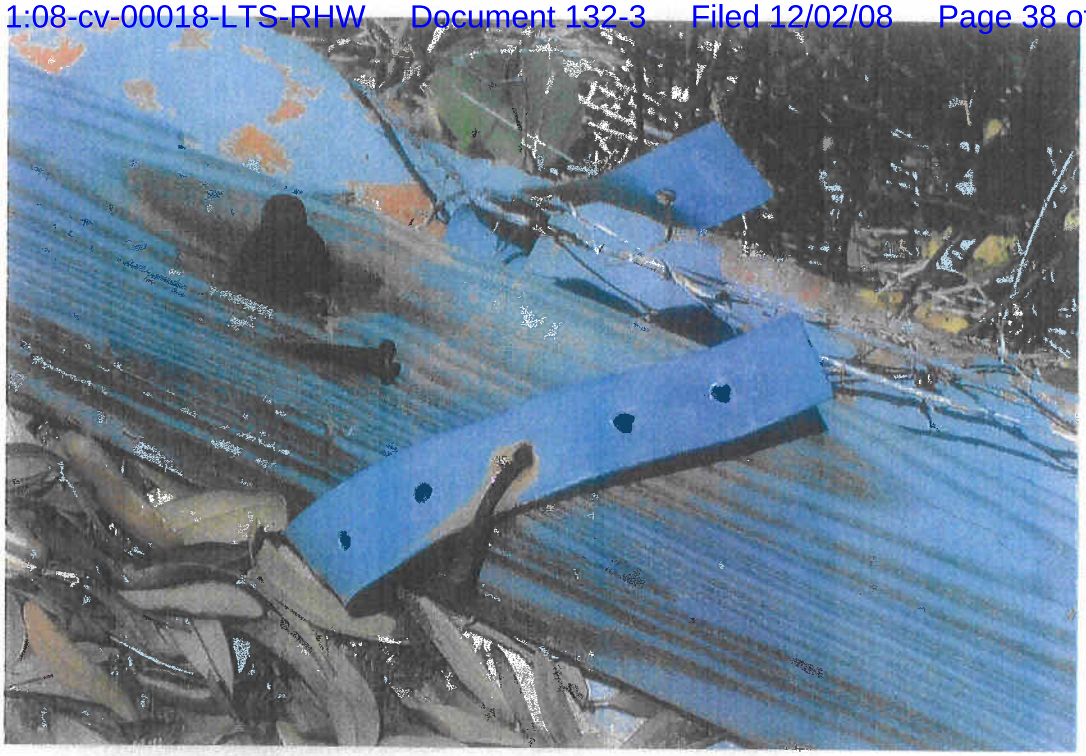




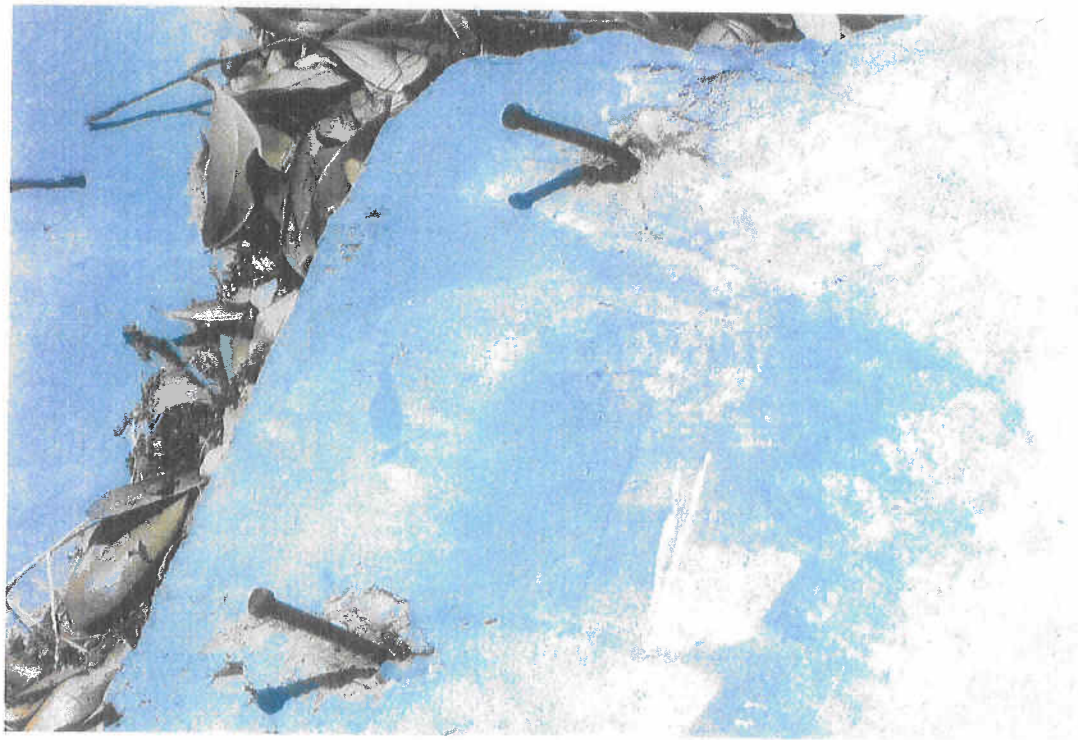
VIEWS OF REMAINING BASE PLATES, NAILED CONNECTIONS, BROKEN METAL STRAPS, AND ANCHOR BOLTS ON CONCRETE SLAB FOUNDATIONS



VIEWS OF REMAINING BASE PLATES, NAILED CONNECTIONS, BROKEN METAL STRAPS, AND ANCHOR BOLTS ON CONCRETE SLAB FOUNDATIONS

VIEWS OF REMAINING BASE PLATES, NAILED CONNECTIONS, BROKEN METAL STRAPS, AND ANCHOR BOLTS ON CONCRETE SLAB FOUNDATIONS

VIEWS OF REMAINING BASE PLATES, NAILED CONNECTIONS, AND ANCHOR BOLTS ON CONCRETE SLAB FOUNDATIONS



VIEWS OF REMAINING CONCRETE NAILS ON CONCRETE SLAB FOUNDATIONS

VIEWS OF REMAINING DAMAGED TREES AT PROPERTY